

Murray Turoff: Father of Computer Conferencing

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In 1971 Murray Turoff, a computer scientist working in the Office of Emergency Preparedness, Executive Offices of the President of the United States, was tasked with developing an electronic information and communication system to aid the US government's response to emergencies. The resulting Emergency Man-

agement Information System and Reference Index (EMISARI), based on a smaller system Turoff created the previous year, is often considered the first computer-mediated, multimachine communications and conferencing system and an early precursor to many of today's chat, messaging, conferencing, and collaboration systems.

Early Years

Murray Turoff was born to Jewish immigrants from Russia and Poland. His father Harry Turoff emigrated from a Jewish area near Minsk, Russia, in 1906 and made his way to America around 1908/1909. His mother Bella Tell came from a rural area in Poland and arrived in America in the early 1920s after World War I. They met in New York, married, and moved to San Francisco in the early 1930s, where Harry, a skilled sheet-metal worker who had learned his skills in Russia, started a shop for handcrafting

soda fountains, steam tables, and other restaurant and bar appliances.

Murray Turoff was the only child of that marriage, although he had two older half-brothers and a half-sister from Harry's previous marriage. As a child, Turoff mostly spoke Yiddish or English at home. His Jewish parents wanted to forget the troubles they had left behind in their old countries. Neither wanted their son to speak Russian or Polish, nor did they speak much about their old countries. Turoff recollected that his mother frequently took him to the main public library close to his home, where his favorite books were Dr. Dolittle, the Oz series, Tarzan, and Mars books. With no television, Turoff read extensively every night. During his teenage years, he often helped his father build soda fountains and steam tables.¹

Math and science came easily to Murray. From the fourth grade onward, this was noticed by his teachers, who often pointed him to higher-level books on these subjects and specialized libraries. During this period, his family lived in a neighborhood that consisted of several lower-income communities, such as Chinese immigrants and African Americans. At the grammar school he attended, the poorer (and tougher) children often "collected" money and food from those who hailed from more successful backgrounds. But because Turoff helped with the older, tougher kids' math problems, he enjoyed "protection" from them!

Background of Murray Turoff

Born: 13 February 1936, San Francisco, California

Education: BA (mathematics and physics), University of California, Berkeley, 1958; PhD (physics), Brandeis University, 1965.

Professional Experience: IBM, San Jose Plant, scientific programmer, 1960–1961; IBM, Boston Branch Office, systems engineer, 1961–1964; Institute for Defense Analysis, research scientist, 1964–1968; Center for Technology and Administration, American University, adjunct professor, 1970–1973; Office of Emergency Preparedness, Executive Offices of the President, senior operations research analyst, 1968–1973; New Jersey Institute of Technology, associate professor, 1973–1979, professor of computer and

information science, 1979–2001, professor of information systems, 2001–2007, Hurlburt Professor of Management Information Systems, 2002–2005, distinguished professor, 1994–2007, distinguished professor emeritus, July 2007 to present.

Honors and Awards: Coauthor of the book *The Network Nation* (with Starr Roxanne Hiltz), winner of the Association of American Publishers Award for the best technical book of 1978; Electronic Frontier Foundation's Computing Pioneer Award, 1994, for "significant and influential contributions to computer-based communications and to the empowerment of individuals in using computers;" ISCRAM Community Distinguished Service Award, 2006.

During these early years, Murray also received training in conservative and orthodox Judaism. He was highly influenced by the erudition of the Jewish Cantor who prepared him for his Bar Mitzvah. Apparently the Cantor kept the students guessing and wondering by always holding back the correct answer to the questions posed to his students.

For recreation, Murray liked swimming and basketball, but his favorite activity seems to have been being a member of a debating club for Jewish boys. By the fourth grade he had decided that he wanted to be a scientist, and by the seventh grade, he wanted to be a physicist because a physicist could “answer the most fundamental questions about universe.” Although Turoff’s parents had expected him to become a doctor or lawyer, they supported his new academic ambitions without reservation.¹

Turoff was admitted to the University of California, Berkeley, as a student majoring in physics in 1954. Turoff’s first exposure to computers came during his last two summers at Berkeley, working at the Hunter Point Naval Radiological Laboratory, in San Francisco. In 1956 Turoff started working with a Burroughs 200-series vacuum-tube computer, learning assembly-language programming. After his graduation in 1958 with a BS in both physics and math, Turoff gained admission and support at Brandeis University, where he went to pursue a PhD in physics.

In the first year of his graduate program, he gained tremendous experience programming IBM computers. The Physics Department at Brandeis had no computer of its own, but it did have access to the Massachusetts Institute of Technology’s large scientific computer, an IBM 704, via a fellowship agreement. Turoff was appointed to learn to use the IBM 704. Whenever a professor in the physics department needed computer programming, Turoff was sent off to work on the problem at MIT. Most of the work involved such things as calculating excitation levels of subatomic particles or calculating turbulence conditions. Turoff recalls that he ended up doing computer work for the alumni office at Brandeis, which was the most computerized department on campus at that time. He also met and became acquainted with many computer science faculty members at MIT, among them Fernando Corbató, a pioneer of operating systems and time-sharing development, in whose graduate programming seminar Turoff was a student.

In the 1960–1961 academic year, Turoff’s thesis advisor, Jack Goldstein, left Brandeis

for a sabbatical in Israel and Turoff took a year off to work for IBM at its San Jose plant. He worked on programming support tools and a numerical control system for the new IBM 1620. After returning to Brandeis, he got a part-time job in IBM’s Boston office as a systems engineer. Given his background in analysis and mathematics, he was used as a consultant to many IBM customers wanting to use new business tools such as linear programming and statistical packages.

Turoff’s computer knowledge grew tremendously during this time, and he eventually developed a computer simulation of a planetary nebula for his doctoral thesis. This was a complex modeling program written in Fortran and, at the time, was the only simulation of a planetary nebula to integrate multiple sets of physical processes within a single working model. While developing and testing this computer simulation, Turoff started getting his ideas on the utility of interactive, online computing.

Working in astrophysics posed a lot of computational challenges to Turoff. It took approximately three hours to run a single case study on the biggest MIT computer. The only time Turoff could use the computer to run the simulation was on Friday or Saturday night after midnight. If his program had an error, he would have to wait a whole week to make another test run. Thus, he was acutely aware of the problem of working on large problems in a batch environment and of the potential of time-sharing to boost user productivity.

Institute for Defense Analysis

Turoff earned his doctoral degree in physics from Brandeis University in 1964 (awarded in 1965) and joined the nonprofit, federally funded Institute for Defense Analysis (IDA) in Alexandria, Virginia. In 1958, IDA was responsible for establishing DARPA.

As Turoff recalled, the IDA hired him because they

wanted a physicist who was familiar with thin plasmas such as in the upper atmosphere and were interested in knowing more about the impact of solar flares and nuclear weapons on the upper atmosphere to predict electromagnetic pulse impacts. [The IDA] ... had problems with computers [and] they [eventually] asked me to turn my attention to my background in that area. A key question at the time was “could a computer actually provide enough computational power for an anti-missile defense system.”²

Turoff worked on this NIKE X antimissile system^{3,4} during his early days at the IDA. While AT&T built the computing elements, Turoff was called on to simulate whether the computers could handle the complexity of the tasks involved. The system had to find and target missiles from the radar and be able to get around jamming devices. It was extremely computationally intensive. The computer was a true multiprocessor system, one of the first ever designed, and had an incredibly fast nanosecond memory.

Over time, Turoff focused more and more on computer problems, and less and less on physics of the upper atmosphere. No one was told what project to work on, but they had to fill a monthly time card with their time allocated to ongoing projects. Turoff always chose to work with people from a variety of disciplines such as social scientists and economists. As he recalls, his time at the IDA was the most interesting part of his career. It was better than any of the institutions and universities that he worked for later with respect to providing an atmosphere for true collaborative, interdisciplinary research. This experience influenced his later interest in communications research.

During the early 1960s, time-sharing was an important new concept. It arose out of the frustrations that computer scientists experienced with batch-processing systems. They envisioned a system where a computer's processing time would be shared between several interactive terminals. MIT was a leading center of work in this area, led by Corbató with whom Turoff was already familiar. Many key time-sharing projects were funded by US military agencies. To track the progress of these projects, the US Department of Defense (DoD) and Navy asked IDA personnel to do a study evaluating all the time-sharing projects underway. Turoff was part of a team of three professionals that travelled around the country to study every time-sharing project, interviewing users and researchers, and trying to predict the impact of this new technology. Turoff stated during an interview that there were a lot of claims of success before any real results. The MIT Project MAC was impressive, but the best system that Turoff saw, in his view, during this study was the JOSS system developed by the RAND.⁵

Office of Emergency Preparedness and Project Delphi

At the time, RAND was involved in several DoD projects. Project Delphi was an Air

Force-funded RAND study of the 1950s to "obtain the most reliable consensus of opinion of a group of experts ... by a series of intensive questionnaires interspersed with controlled opinion feedback,"⁶ Turoff was quick to see the benefits of using the Delphi concept in group decision making and wanted to see if he could computerize the Delphi approach.

Turoff met Norman Dalkey, one of Delphi's three main developers, during a NATO professional conference on strategic modeling in Amsterdam. At the time, there were already a lot of people in government engaged in Delphi-based forecasting studies. As Turoff recalled,

Norm and I went out one evening to tour the red light district in Amsterdam and ended up talking about Delphi and some work I was doing on gaming to allow people to play roles online in strategic war games rather than trying to make assumptions about human actions and program them directly in the game. So we were both very interested in the same human collaboration problem which is addressed by Delphi.²

Turoff left the IDA to join the Systems Evaluation Division (SED) of the newly formed Systems Evaluation Division in the Office of Emergency Preparedness (OEP) in 1968. This office advised and assisted the President in the coordination and determination of the federal emergency preparedness policy.⁷ Its accomplishments included the first government Energy Conservation Study and the cost optimization of the government phone network using advanced network analysis techniques for nonlinear modeling.

The first Delphi study Turoff designed was a forecasting study on the future of the steel and ferroalloy industry with the collaboration of the National Academy of Engineering and 44 planners from various companies.⁶ After this the director of the OEP, General George A. Lincoln (Eisenhower's logistic general in World War II and a West Point professor) told Turoff that he wanted to obtain information and arguments that were contrary to his own so that he could then be prepared to defend his own policy decisions when they were made public. He asked Turoff to build a Delphi incorporating supporters of different responses to a given policy issue into one communications process. Turoff thus designed a Delphi structure "to produce the strongest opposing arguments

about resolutions to a policy issue, using the properties of a Hegelian Inquiry process as defined by C.W. Churchman."⁸

The Delphi process was slow and expensive. After a situation was presented to a large group, the initial responses were collected and analyzed to define a specific problem. This was followed by similar processes of identifying solutions and then reaching a consensus of the best possible response to the problem. Turoff realized that using an online, interactive computer system would eliminate much of the tedium of data collection and collation as well as reduce the influence of individual group members. His online Delphi eliminated the round structure and allowed the participants to participate at any time, in any part of the discussion. One long-term objective was to make better use of the thousands of presidential advisors, many of whom were volunteers from industry and academia with professional knowledge relevant to the types of national emergencies for which OEP was responsible.

This system went into operation in the spring of 1970 on an experimental basis. It was built with the Language Systems and Development (LSD) Corporation, hired by OEP to help with some systems software problems for its Univac 1108. As a test, Turoff asked 20 associates, many well-known computing researchers, to participate in determining uses for this new tool. This first online Delphi discussion started on 16 March 1970 and stretched over 13 weeks.

The experiment was approved in private by Robert H. Kupperman, assistant director of the OEP. However, Turoff soon ran into trouble when the computer services division personnel started noticing that people outside the computer lab and OEP who were participating in the Delphi experiment were gaining access to the computer. When this was discovered, Turoff had to be symbolically "punished" for giving outsiders access to the OEP computer, and Kupperman took his computer terminal away for several weeks!⁹

The Wage-Price Freeze Problem and the Role of EMISARI

The success of the online Delphi experiment led to development of the EMISARI computer conferencing system a year later. The catalyst was a wage-price freeze¹⁰ promulgated by President Richard Nixon on 15 August 1971 in a dramatic, but ultimately futile attempt to pull the economy out its inflationary spiral.

At the start of the wage-price freeze, the OEP director got on a conference call with

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about 25 regional officers and asked if anyone had any problems. He was largely greeted with silence. Kupperman later recalled that Turoff took a teletype home, worked round the clock, and came back with a working first version of EMISARI in four days. A week later, the real-time chat feature of Turoff's modified Policy Delphi (Party Line) was used for the same function. The input of problems were in text, some anonymous. This conference lasted for more than two hours.

A decision was then made to operate EMISARI in parallel with the use of faxes, telegrams, and phones. The 16 regional offices of the OEP had to respond to requests and inquiries, and the OEP management had to ensure that policy interpretation was correct in all regions. The computer running the system was connected to their remote teletype terminals via government telephone lines.

After three weeks, the other alternatives could not keep up with much of what was going on and gradually every discussion was moved over to the EMISARI operation. During the first 10 weeks of the wage-price freeze, EMISARI was accessed 900 times for entering data, the policy files were accessed 1,900 times, and individual estimates and text messages were accessed 2,900 times. There were 80 terminal users at this time.¹¹

Turoff designed the EMISARI as a full-fledged computer conferencing system, not limited to just the context of emergency management. A conscious decision was made to limit text comments to 10 lines so people would stop trying to write typical government memos. Based on user feedback, a group of about 10 programmers and Turoff were continually engaged in designing and implementing extensions throughout the three-month period that OEP was the primary agency for the wage-price freeze.

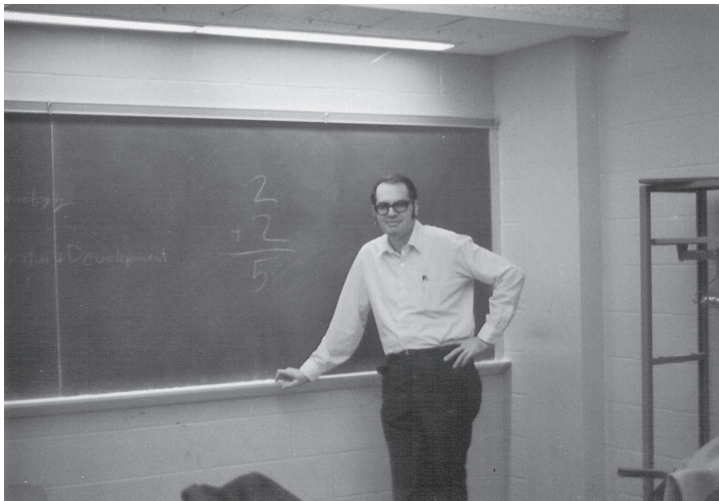


Figure 1. Murray Turoff in 1974. After leaving the Office of Emergency Preparedness, Turoff joined the New Jersey Institute of Technology. (Photo by Sonia Khalil.)

Existing management information systems seldom provided any feedback to the people responsible for entering data. In contrast, in EMISARI anyone could see when and who had reported a given data item. Because both messages and conference comments were possible and a directory maintained everyone's responsibilities, it was quick and easy to engage in relevant discussions.

There were three ways by which system members could talk to each other using their terminals:

- A "party line" allowed simultaneous conversations of 15 persons. This disappeared after the conference was over. (This was an early precursor of today's chat systems.)
- A "discussion" section stored written conversations. (This was much like today's blog and wiki postings with comments.)
- Messages between contacts could also be attached to specific posted data items such as tables and footnotes. (This bears a lot of similarities to the capabilities of email and Facebook, where documents from an external source can be posted and annotated by individuals, who can then share it with their friends.)

The system also underwent considerable program improvements, implemented in XBasic by LSD and evolved into EMISARI-RIMS (Resource Interruption Monitor System).¹² Despite its success, however, the

EMISARI system became a point of contention between the original personnel of the Computer Lab at OEP and the management, under whose control the EMISARI operated. The former resented the enhanced role and visibility of people working under Turoff. When the OEP was dissolved in 1973 and absorbed into a new agency, the Federal Preparedness Agency (FPA) under the General Services Administration (GSA), the EMISARI project was not adequately funded. Assistant Director Kupperman, an unstinting supporter of EMISARI, left the organization. So did the main EMISARI team, consisting of Murray Turoff, Richard Wilcox, and Nancy Goldstein.

EMISARI was mostly dormant from then on, but it continued to be pressed into service during national crisis situations, such as the voluntary petroleum allocation program in 1973. In 1974, during the national truckers' strike, it was used nationwide to provide the White House with twice-daily reports. Despite these successes, the neglected system had, for all practical purposes, died by 1975. Turoff recalled that "The discussion piece with party line, discussion, and conference and including voting went into the (Univac) 1108 software sharing system and lived on for some time in a number of university computer services departments for internal management or user service."²

The Emergence of the Networked Society

Murray Turoff left OEP and joined the New Jersey Institute of Technology in 1974 (see Figure 1). This was a period of intense collaboration between Turoff and Starr Roxanne Hiltz, who was chair of the sociology department at Uppsala College in New Jersey. Upon joining NJIT, Turoff hoped to involve a social scientist to evaluate the use and design of these systems. When Turoff met Hiltz in 1974, she was already doing several research projects on networked communities. Turoff's appointment at NJIT required that he bring in research funding from external sources. Together, Turoff and Hiltz worked on a US National Science Foundation request for proposal (RFP) that eventually funded the development of a next-generation computer-mediated conferencing (CMC) system, the Electronic Information Exchange System (EIES), as well as provided funding for "an invisible college of researchers," who would participate and collaborate using the system.

The NSF supported the EIES development and put out a special RFP that allowed

potential user groups to use EIES to support their communities in exchange for system evaluations (see Figure 2). EIES allowed communication structures to be customized for the needs of particular groups. Many tailored CMC systems were developed for such areas as project management, standards setting, planning, online learning, and group-decision-support systems.

EIES users subsequently developed other systems such as FORUM, the WELL, and KOM (in Europe). EIES also had the first user-oriented marketplace system, which had a successful test allowing any EIES user to buy and sell information using play money. It incorporated public feedback from those that had made a purchase.¹³ (As a state university, NJIT felt it could not operate such a system using real money.)

The Network Nation

The idea of studying online social behavior was radical. When Hiltz sent a paper on the use of computers to support social communities to the American Sociological Association (ASA) journal *American Sociological Review*, she received back a letter that the paper would be rejected without review because, as Hiltz recalled, “sociologists did not study computers ... it was not appropriate subject matter.”¹⁴ After that, she mostly published in the computing literature.

In 1978, the book *The Network Nation*, coauthored by Turoff and Hiltz, became a defining document and a standard reference in computer-mediated communications.⁹ In her 1993 review of the book in *The Village Voice*, Pulitzer Prize winning author Teresa Carpenter said,

The Network Nation ... contained a fascinating vision. In it home computers are as common as the telephone. They link person to person, shrinking, as the authors put it, “time and distance barriers among people, and between people and information, to near zero.” In its simplest form, *The Network Nation* is a place where thoughts are exchanged easily and democratically and intellect affords one more personal power than a pleasing appearance does. Minorities and women compete on equal terms with white males, and the elderly and handicapped are released from the confines of their infirmities to skim the electronic terrain as swiftly as anyone else.

My interviews with Turoff and Hiltz revealed that the original idea for the book came from Hiltz in 1975. By late 1975, Turoff



Figure 2. Murray Turoff (center) and Starr Roxanne Hiltz (center right) with the first Electronic Information Exchange System (EIES) system at New Jersey Institute of Technology in 1974.

had implemented the first version of EIES at NJIT, and the system was actively being used by seven online communities. While Turoff focused on the technical aspects, Hiltz focused on the sociology of networked communities and distributed group support systems. By late 1975, the groups had been interacting within the EIES systems for a year. With one year's data in hand, Hiltz began envisaging the future of these networked communities, and the use of such online networks in society at large. Other sociologists were also beginning to get interested in the idea of networked communities. The idea of the book was born.

Hiltz and Turoff envisaged that the book would comprise “hard” elements, such as the technology behind EIES, and the results of various sociological research that Hiltz carried out. At the same time, the book could make some playful and funny projections about the future in the form of news headlines from a fictional “BosWash Times.” Three and a half decades hence, it is interesting and astonishing to see how close their predictions were to what is currently happening with social networks.

By the time the book was published, Hiltz was brought into NJIT's computer science department, first as a consultant and then as a professor. Their collaboration focused on networked communities. Soon Turoff's system attracted other researchers, especially those involved in social-network analysis. They joined the EIES community, and their work on EIES spawned a new journal on social-network analysis, which was started as an online journal first and then became a hard-copy journal. These online communities provided Hiltz with readily available

research subjects. She also got an additional research grant to study distributed support systems, which gave Hiltz and Turoff the idea that it was possible to have more rational meetings online.

Work Since 1970s

Throughout the 1980s and early 1990s, Turoff's EIES was the main experimental platform for numerous researchers and developers interested in creating and evaluating collaborative systems and the ramifications of such a system in the shaping of society. Turoff and Hiltz's research—namely the EIES system itself, and the study of the sociology of networking communities—spawned more than 18 doctoral dissertations and hundreds of master's projects in the 1980s and 1990s.

With funding from a variety of sources (such as the NSF, IBM, the Annenberg Foundation and Corporation for Public Broadcasting, the New Jersey Department of Education, and the New Jersey Commission for Science and Technology), the original EIES system, which ran on a mainframe, was enhanced with tailorable interfaces suitable for smaller organizations that could rent time from a mainframe system. Various “products,” were developed. They included tools for developers and system integrators and “virtual classroom” enhancements for educational use.¹⁵ The conference center at NJIT also offered a range of training and support options to EIES users.

Turoff and Hiltz were awarded the Electronic Frontier Foundation's Computer Pioneer Award in 1994 for “significant and influential contributions to computer-based communications and to the empowerment of individuals in using computers.”¹⁶

Turoff retired from NJIT in 2007 and is currently a professor emeritus. After retirement, he has become actively involved in the International Community on Information Systems for Crisis Response and Management (ISCRAM), in which he serves as a board member. He continues to use his Delphi method to develop preparation and response strategies for global crisis management.

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